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AUTHOR Chatala, Elizabeth S.; And Others
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ABSTRACT

In an incidental memory task, second, sixth, and tenth-grade students performed three orientating tasks on different subsets of items in a list of common nouns. In one condition (EPA), children judged words on the Evaluative, Potency and Activity dimensions of the semantic differential. In another condition (EEE) children made phonetic judgments. Analysis of recall scores supported the hypothesis that superiority of semantic over phonetic encoding would increase with age. However, results did not support the hypothesis that superiority of the EPA condition over the EEE condition would emerge with age as children's semantic structures become more differentiated. In fact, the two conditions did not differ at any grade. In a second experiment, a shift in recall favoring the EPA over the EEE condition was observed between tenth-graders and adults. It was speculated that in addition to dimensional independence which emerges by age 12, relatively equal weighting of dimensions within semantic structure, which may not appear until adulthood, is a necessary condition for the facilitating effect of multiple dimension encoding to occur. (Author)

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Effects of Developmental Changes in Affective Meaning Structure on Memory

Elizabeth S. Ghatala, Joseph P. Carbonari
and H. Lee Wylie
University of Houston

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Abstract

In an incidental memory task, second, sixth, and tenth-grade students performed three orientating tasks on different subsets of items in a list of common nouns. In one condition (EPA), children judged words on the Evaluative, Potency and Activity dimensions of the semantic differential. In another condition (EEE) children made phonetic judgments. Analysis of recall scores supported the hypothesis that superiority of semantic over phonetic encoding would increase with age. However, results did not support the hypothesis that superiority of the EPA condition over the EEE condition would emerge with age as children's semantic structures become more differentiated. In fact, the two conditions did not differ at any grade. In a second experiment, a shift in recall favoring the EPA over the EEE condition was observed between tenth-graders and adults. It was speculated that in addition to dimensional independence which emerges by age 12, relatively equal weighting of dimensions within semantic structure, which may not appear until adulthood, is a necessary condition for the facilitating effect of multiple dimension encoding to occur.

Attribute Structure and Incidental Memory for Words: Test of a Developmental Hypothesis

The structure of affective attribute dimensions by which individuals judge environmental events appears to change with age such that attributes are highly intercorrelated for young children but become less so for older children and adults (Ervin & Foster, 1960; Saltz, Dunin-Markiewicz, & Rourke, 1975). The present study represents an initial exploration of potential mnemonic consequences of such age-related differences in semantic attribute structure.

Our approach to this issue was guided by several recent studies of encoding and memory which demonstrate that semantic processing of words does not occur in an all or none fashion but rather that the specific attributes of a word's meaning encoded by subjects depends upon context and task demands. Moreover, it appears that memory for words is, in turn, affected by the number and distinctiveness of the particular attributes encoded. For example, Klein and Saltz (1976), using an incidental memory task, found that words judged on two semantic rating scales were better recalled than words judged on one scale and that recall was inversely related to the degree of correlation between the two scales. In a subsequent study, Ghatala and Carbonari (Note 1) employed Osgood's semantic differential to further explore adults' incidental memory for words as a function of the degree of correlation between semantic encoding dimensions. Briefly, Osgood's factor analytic studies (Osgood, Suci, & Tannenbaum, 1957) indicate the existence of three primary dimensions of affective meaning in adults -- the Evaluative, Activity and Potency dimensions --

which are represented by independent clusters of intercorrelated bipolar adjective scales. In one condition of their study, Ghatala and Carbonari required adults to judge words on three different bipolar adjective scales related to the same affective dimension (e.g., subjects judged words on the three Evaluative scales: good-bad, right-wrong, friendly-unfriendly) while in another condition subjects judged words on three scales related to different dimensions (e.g., good-bad, strong-weak, fast-slow). Recall was significantly better in the latter condition. Because rehearsal opportunities and retrieval cues were equated for the two conditions, this result can be attributed to differences in distinctiveness (or degree of correlation) of the adjective scales in the two conditions.

The research on affective meaning development alluded to earlier suggests that the dimensional structure presumably responsible for the differences in encoding distinctiveness obtained by Ghatala and Carbonari emerges with age. Thus, Saltz et al, (1975) found that the semantic structure of young children is collasped upon a single general-evaluative dimension (i.e., for young children anything that is good is also strong and fast) and that Activity and Potency emerge as independent dimensions somewhere between 6 and 9 years of age. Moreover, Ervin and Foster (1960) found that the degree of intercorrelation between evaluative terms (e.g., good, kind, friendly) steadily decreased between the ages of 6 and 12 years.

If such developmental differences in semantic structure have memorial consequences, then one straight-forward prediction is that

the encoding distinctiveness effects found Ghatala and Carbonari with adults would not be found in young children. That is, judging words on Evaluative, Potency, and Activity scales should produce no more distinctive encodings in young children's episodic memories than judging words on three Evaluative scales since all scales in both conditions are highly intercorrelated. With age, as attribute structure becomes more differentiated, the intercorrelations among scales in both conditions should decrease, however, at some point during development the intercorrelations among scales representing the three dimensions should fall below those among scales representing only the Evaluative dimension and hence a memory difference between the two encoding tasks should appear.

One purpose of the present study, then, was to examine age related changes in the effects of these two types of orienting tasks on incidental memory for words. In addition, an acoustic encoding condition was included in the design in order to provide a baseline against which to gauge developmental changes in the two semantic encoding conditions since previous research (Ghatala, Carbonari, & Bobele, in press) has found no age-related changes in memory for acoustically encoded words.

Experiment I

Method

Subjects. The subjects were 21 second-grade children (mean age = 7.1 years), 21 sixth-grade children (mean age = 11.4) and 21 tenth-grade children (mean age = 15.7) attending parochial schools in middle-class urban neighborhoods. There were 10 females and 11 males in each age group.

Materials and Procedure. The children were tested individually and all received the same order of 12 high-frequency concrete nouns. Four words were randomly assigned to each of the three processing conditions. A counterbalancing procedure was employed such that each of the processing tasks was performed on each set of four words by some subset of subjects in each grade. Each of the processing tasks occurred once in each block of three words. The task was introduced as a word game with no mention of any memory requirement. As each word (typed on a 5 x 8 in. card) was shown, the experimenter pronounced the word and then required the child to make 3 judgments about the word. In the EPA condition, the experimenter gave the polar adjectives for an Evaluative scale (good-bad), Potency scale (strong-weak) and Activity scale (fast-slow). For each pair of adjectives children selected the one which best described the word. In the EEE condition three Evaluative adjective pairs were given (good-bad, kind-mean, friendly-unfriendly). The order of the pairs and order of adjectives within pairs was randomly determined for each word. All of the adjective scales were highly appropriate for the 12 words as determined from a previous norming study. In the acoustic condition, children decided whether each of three sounds given by the experimenter were contained in the word. For each word, two sounds were present and one was not. The experimenter recorded the students' three judgments for each word. Three practice trials, one for each condition, were given. Following the orienting activity, the children engaged in a counting task for 1 minute and then were given 2 minutes to recall as many of the words as they could.

Results and discussion

The mean number of words recalled as a function of grade and condition is shown in Figure 1. A 3(grade) x 3(condition) mixed analysis with grade as a between and conditions as a within-subjects factor was conducted. Planned, orthogonal comparisons among conditions indicated that the EPA

Insert Figure 1 here

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and EEE conditions did not differ significantly, $F(1,120) = 3.02$, $p>.05$; however, the average of these two semantic processing conditions was significantly higher than the acoustic condition, $F(1,120) = 63.07$, $p<.001$. The main effect for grade was significant, $F(2, 60) = 13.22$, $p<.001$. Furthermore, grade interacted with the contrast between the average of the EPA and EEE conditions and the acoustic condition, $F(2,120) = 8.49$, $p<.001$. From Figure 1 it is apparent that recall generally increased monotonically with grade level but that the age-related increase in recall was much greater in the EPA and EEE conditions than in the acoustic condition. Subsequent trend analyses confirmed this visual impression: The linear component of the grade effect was significant, $F(1,120) = 25.85$, $p<.001$ as well as the linear component of the interaction between grade and the semantic-acoustic contrast, $F(1,120) = 16.49$, $p< .001$. The quadractic component was not significant for either effect.

The finding that the magnitude of the recall difference between semantic and acoustic encoding tasks increased with age is

in agreement with the results of Ghatala, Carbonari and Bobele (in press) who found age related increases in recall across second, fifth and ninth grades when the orienting tasks focused on denotative categories of words but not when they focused on acoustic properties of words. Their interpretation of this result would also appear to be relevant to the present data. That is, children's knowledge of phonetic properties of words develops quite early and does not appear to change quantitatively or qualitatively beyond the age of three years. On the other hand, the extent and complexity of children's semantic knowledge continues to increase during the school years. This increase is extent, complexity, and, in the present case, differentiation of semantic structure may result in more elaborated (or distinctive) and hence more memorable traces (according to recent formulations, cf. Postman, Thompkins, & Gray, 1978) being laid down in episodic memory.

The expected superiority of the EPA over the EEE condition did not emerge at either the sixth- or tenth-grade level. Descriptively, at all three grade levels, recall in the EPA condition was slightly less than in the EEE condition.

It may be recalled that in previous research a difference favoring the EPA over the EEE condition was found with adults (Ghatala & Carbonari, Note 1). That result, combined with the findings of Experiment 1 suggest that a shift in the effects of these two types of orienting tasks on incidental memory may occur between adolescence and adulthood. Experiment 2 was designed to directly assess this hypothesis.

Experiment 2

Method

Subjects. The adults were 19 students enrolled in a graduate level education course and were between 25 to 35 years of age. A sample of 19 tenth-grade students (mean age = 15.8 years) was obtained from the same population as sampled in Experiment 1.

Materials and procedure. The words and orienting tasks were the same as used in Experiment 1. However, the task was adapted for group administration through the use of a printed rating form on which students marked their judgments of the words as they were read aloud. The experimenter read words at a 4-sec. rate. The group procedure provides continuity with previous research with adults (Ghatala and Carbonari, Note 1) and was necessitated in both instances by the great difficulty in scheduling individual sessions with available adult subjects. Students at each age-level were tested during a regular class period. Task instructions and counterbalancing procedures were the same as in Experiment 1. Arithmetic problems served as the distracton task in place of the counting task and a 2-min. written recall period replaced the oral recall used in the first experiment.

Results and discussion

The mean numbers of words recalled by tenth-grade students and adults are shown in Table 1. Orthogonal, planned

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Insert Table 1 about here

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comparisons indicated that the EPA and EEE conditions did not differ significantly, F (1, 72) < 1. The average of the two semantic processing conditions was

significantly higher than the acoustic condition, $F(1,72) = 64.04$, $p<.001$. The main effect for grade was significant, $F(1,36) = 25.73$, $p<.001$, and grade interacted with the contrast between the EPA and EEE conditions, $F(1,72) = 5.98$, $p<.02$. From an inspection of the means for the two semantic conditions at each age level it is apparent that the EPA condition produced better recall than the EEE condition for adults but that for tenth-graders, the EEE condition was slightly superior to the EPA condition. This latter result agrees with the finding from the first experiment; in fact, the pattern of results obtained for tenth-grade students was quite similar in Experiments 1 and 2 despite procedural changes.

Thus, for adults, words judged on minimally correlated scales marking different dimensions were better recalled than words judged on highly correlated scales marking the same affective dimension which confirms previous findings (Ghatala and Carbonari, Note 1; Klein & Saltz, 1976). However, this effect was clearly not present in younger subjects. Our original expectation regarding an age-related change in the relative memorial effects of the two semantic orienting tasks prior to age 16 was based on studies of semantic development which suggest that the three-dimensional, differentiated structure characteristic of adults may not be manifested totally by second-grade students, but is surely present in tenth-grade students and most probably in sixth-grade students as well. In order to determine whether these presumed age-related similarities and differences in semantic structure influenced encoding in the present task, we examined students' judgments of words along the three dimensions in the EPA condition.

In accordance with previous research we should find encoding of adults, tenth- and sixth-grade students to be quite similar but different from that of second-grade students.

It will be recalled that each student made three judgments for each of four words in the EPA condition by selecting either the positive or negative member of bipolar adjective pairs marking the Evaluative, Potency and Activity dimensions. Table 2 shows the proportion of times the positive member of the adjective pair (i.e., good, strong, fast) was selected for each dimension at each age level in the two experiments.

Insert Table 2 about here

Several things can be noted from Table 2. First, students at all age levels tended to give more positive than negative judgments for this set of stimulus words. This was particularly true for the Evaluative and Potency dimensions. Second, in Experiment 1 there was a high degree of similarity between sixth - and tenth-grade encoding patterns but less similarity between each of these patterns and the pattern shown by second-grade students. Third, in Experiment 2, the pattern obtained for the tenth-grade and adult students was very similar. Finally, the pattern exhibited by the tenth-graders in Experiment 1 was virtually identical to that shown by the tenth-graders in Experiment 2 indicating that (just as procedural differences between the two experiments did not affect the pattern of recall for the tenth-grade students) the encoding responses of tenth-graders were also not altered

by changes in procedure between the two experiments.

A somewhat more informative description of encoding in the EPA condition was obtained by considering students' pattern of responses across pairs of dimensions. There are four possible response combinations when students' judgments of the words along two dimensions are considered jointly -- the positive member may be selected from each adjective pair (e.g., E_+P_+), the positive member may be selected from one adjective pair and the negative member from the other (e.g., E_+P_- or E_-P_+), or the negative member may be selected from each adjective pair (e.g., E_-P_-). In Table 3 are shown the proportions of students' responses in each response-combination category for each possible pair of dimensions as a function of age - grade level.

Insert Table 3 about here

(For purposes of this analysis, the age-grade groups from the two experiments were considered together since results reported earlier for the two tenth-grade samples indicated that the change from individual to group testing procedures did not affect recall or encoding patterns.)

Considering the paired Evaluative and Potency dimensions, the distribution of students' responses over the four response combinations did not differ as a function of group ($X^2 = 3.84$, $p>.05$). However, the groups did differ in their distributions of responses for the paired EA ($X^2 = 20.32$, $p<.07$) and PA dimensions ($X^2 = 30.94$, $p<.01$). In each case, subsequent pair-wise comparisons

revealed that the distribution for second-grade students differed from the distributions for the sixth-grade, both tenth-grade, and the adult groups but that the distributions of these latter groups did not differ.

For the second-grade students, it appears that judgments along the A dimension were not as independent from judgments along the E and P dimensions as they were for the older students. Thus, given that a positive response was made on either the E or P dimensions (and for this set of stimulus words, a majority of E and P judgments were positive, see Table 2), second-graders were more likely to give a positive judgment on the A dimension than were older students. These results are consistent with the findings of Saltz et al. (1975) that a two-dimensional attribute structure (Evaluative plus Potency) accounted for most of the judgments of their six-year-old sample, but that these two dimensions were joined by the Activity dimension in accounting for the reliable variance of judgments of their nine-year-olds.

Further evidence of a relative lack of independence among judgments of second-grade students was obtained when students' juegments of the words along all three dimensions were considered. In fully 50% of the cases, second graders gave the same type of judgment ($E_+P_+A_+$, or $E_-P_-A_-$) on the three dimensions; whereas students in all other groups gave the same type of judgment across dimensions only 27.5% of the time on the average (sixth-grade = 27%; tenth grade, Experiment 1 = 26%; tenth grade, Experiment 2 = 29%; adults = 28%).

The above results which substantiate earlier studies of

semantic development indicate that our adults, adolescents, and sixth-grade children were encoding the stimulus words in the same fashion and that a shift in encoding occurred between second and sixth grades. However, the expected difference in recall favoring the EPA over the EEE condition did not accompany this shift in encoding but, rather, occurred at a much later age. One possible explanation for this finding is based upon Saltz et al's. (1975) observation that the weight of the general evaluative factor decreased systematically between 6 years of age and college. While in college-age subjects, the Evaluative dimension was weighted more than any other dimension, the difference between dimensions was quite small compared to 6 and 12 year-old children. Thus, it may be that relatively equal weighting of dimensions as well as their independence are necessary conditions for the facilitating effect of encoding words on multiple semantic dimensions, and that the former condition (in the case of the Evaluative, Activity and Potency dimensions) is not satisfied until adulthood. Obviously, further research is necessary to explore this notion.

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Table 1

Mean Number of Words Recalled by Tenth-Graders and Adults as a Function of Encoding Conditions

	Encoding Conditions		
Grade	Acoustics	EEE	EPA
Tenth-Grade	1.47	2.79	2.36
Adult	1.89	3.21	3.74

Note: E = Evaluative dimension , P = Potency dimension, A = Activity dimension

Table 2

Proportion of Positive Adjective Choices For Each Dimension in the EPA Condition at Each Age-Grade Level

Experiment 1

	Semantic Dimension		
Grade	E	P	A
Second	.61	.90	.82
Sixth	.61	.87	.64
Tenth	.61	.89	.56

Experiment 2

	Semantic Dimension		
Grade	E	P	A
Tenth	.64	.88	.59
Adult	.63	.92	.58

Note: E = Evaluative dimension (good,bad); P = Potency dimension (strong-weak); A = Activity dimension (fast-slow)

Table 3

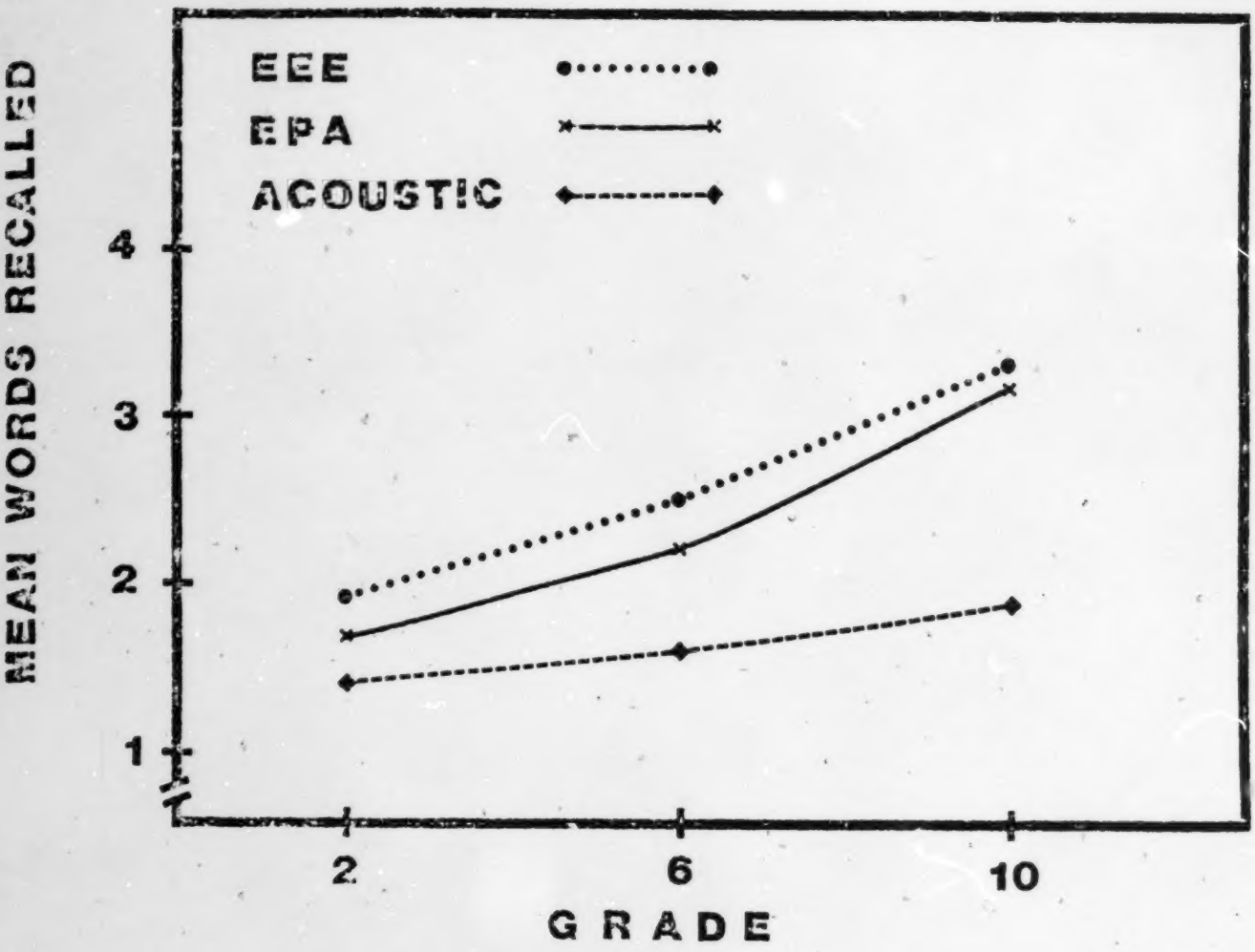
Proportion of Responses in Four Response-Combination Categories for Pairs of Dimensions as a Function of Age-Grade Level

	EP Response Combinations				EA Response Combinations				PA Response Combinations			
Grade	E+P+	E+P-	E-P+	E-P-	E+A+	E+A-	E-A+	E-A-	P+A+	P+A-	P-A+	P-A-
Second	.53	.07	.36	.04	.48	.13	.34	.05	.82	.08	.00	.10
Sixth	.50	.11	.37	.02	.30	.31	.34	.05	.61	.26	.04	.10
Tenth (I)	.51	.10	.38	.01	.26	.35	.30	.10	.55	.35	.01	.10
Tenth (G)	.56	.08	.32	.04	.30	.34	.29	.07	.54	.34	.05	.07
Adult	.55	.08	.36	.01	.30	.33	.28	.09	.55	.37	.03	.05

Note: E = Evaluative dimension; P = Potency dimension; A = Activity dimension, Tenth (I) = Individually tested tenth-graders in Experiment 1; Tenth (G) = Group tested tenth-graders in Experiment 2.

Figure Caption

Figure 1. Mean number of words recalled as a function of grade and encoding condition.


EEE
EPA
ACOUSTIC
MEAN WORDS RECALLED
4
3
2
1
2
6
10
GRADE